4-2020

Test Device and Process for Assessment of Smithfield Facility Aging

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Problem Statement

● Establishing structural objective tests and recommendations for hog production facilities.

● The risks are to the livestock, growers, and Smithfield for potential collapses of hog facilities in NW Iowa.

● We assess our solution to be applicable to a large portion of the hog production industry to quickly and objectively measure truss deterioration and provide detailed monetary and structural guidance to growers.

Disciplines

Bioresource and Agricultural Engineering | Industrial Technology

Iowa State University

Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

Test Device and Process for Assessment of Smithfield Facility Aging

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- Contact(s): Robert Coffelt, Organizational Improvement Manager, bcoffelt@smithfield.com, 712-229-8899; Ray Foerster, Regional Production Manager, rfoerster@smithfield.com, 712-221-0320.

1 PROBLEM STATEMENT

Predicting naturally ventilated Swine facility life expectancy in the NW ¼ of Iowa.

A. Problem Statement

- Establishing structural objective tests and recommendations for hog production facilities.
- The risks are to the livestock, growers, and Smithfield for potential collapses of hog facilities in NW Iowa.
- We assess our solution to be applicable to a large portion of the hog production industry to quickly and objectively measure truss deterioration and provide detailed monetary and structural guidance to growers.

B. Business Case Statement

- For an objective and repeatable process to judge the useful life of a Smithfield hog facility, recommended techniques to reinforce truss plates, and measure truss chord deflection more accurately. (See section 3.6 of the Appendix for Reinforcement details)

- The problem has a vast amount of variables and assumptions that can only be analyzed using historical data and first-hand experience from Smithfield team members and growers who have experienced the problems themselves.
- The most significant problems within the facilities are trusses. Four critical components have been isolated to determine the integrity of the roof.
- This analysis allows Smithfield and the growers to identify major issues sooner and give them an objective, accurate, and repeatable, objective test to estimate the useful life of their facility. Historical data suggests the current lifespan is 20-30 years. It also gives them new recommendations for repairing and extending the life of their facility while comparing an added value per year to a complete rebuild.

2 MAIN OBJECTIVE

A. The fundamental improvement required is the ability for Smithfield to objectively evaluate useful life remaining in hog production facilities and decide on the best course forward.
B. The improvement will be measured by Smithfield's confidence in the evaluation methods.
    - Data was collected on the various levels of deterioration seen along with specific points of a truss. Truss plates, butt plates, eve braces/hurricane clips, and deflection are all specific parameters that were measured and included in our document as evaluation tests.
    - The document we procured has images of points critical to the structural integrity of a truss. These images show these critical points at a quality of 100%, 75%, 50%, and 25%. These levels of deterioration are summarized to provide an approximate state of the entire facility, and the remaining useful life of the facility.
      (See section 3.4 of the Appendix for images used to rate each test.)

Project Objectives

A. Main objectives: Create a document that meets all client criteria and constraints
    - Develop a timeline to estimate the safe, useful life of a Murphy Model 1100 pork production facility. (Useful life ratings found in section 2.5 of Appendix)
    - Identify structural failure points by type and precedence.
    - Determine effective alternative structural reinforcement recommendations.
    - The cost-driven analysis of when to repair or replace a facility based on its age and condition.
B. Project Scope
    - The project scope was altered to only concern Murphy 1100, naturally ventilated hog production facilities. This change was a mutual decision on the part of both the team and client based on the direction the project developed.

3 METHODS/APPROACH

We began by forming our team based on prior experience and specific skills and knowledge. After we had our team positions established, we gathered a vast amount of data from Smithfield, EPS, department faculty, industry-related reference material, and several structural truss evaluation documents. Brainstorming and continuous communication with the client allowed us to dial in our scope and focus on finding the main components of failure within the facilities.

A. Methods/Approach

Data collection:

- Data associated with our project includes critical deterioration points in the structure of a hog production facility, deterioration of a facility compared to its active life, and costs of repair methods and total replacement of the facility.
- Data were collected by observing facilities, taking pictures, and asking Smithfield various questions about the age and cost of facilities.

1. Skills:
   - The needs of the grower, Smithfield, and overall sustainability of hog production facilities in NW Iowa were crucial for accurately understanding the problem.
   - Classes taken that were beneficial to solving this problem include TSM 443 (Statics), TSM 214 (Project Management), TSM 115 (Solving Problems in Industry), TSM 310 (Total Quality Improvement).
2. Solutions:
   - The solution we provided was developed by creating an objective method to evaluate the structural integrity of trusses in a hog production facility.
   - The points most critical to the structural integrity of a truss was a metric used to evaluate solution options.
   - Estimating the useful life remaining in a facility was measured by the deterioration level of critical points in the trusses of a facility.
   - The monetary value that can be attached to this solution is preventing insurance premiums from rising for Smithfield based on the evaluation procedure we provide, preventing future facility collapses.
3. Organization: We communicated bi-weekly with the client through conference calls and regularly with emails, agendas, and meeting minutes.
   - Project-related data, notes, references, and all other important materials were shared within a google drive which allowed us to simultaneously work on and share information with each other
   - Major milestones for our project included establishing a scope, having a conference call, first facility visit, initial preventive maintenance document sent to Smithfield, first tests with the document, the submission with a satisfied client

B. Timeline (Detailed Gant chart of Timeline found in section 1 of Appendix)

4 RESULTS

Results/Deliverables

- Develop a timeline for the estimated structural safe, useful life of a Murphy Model 1100 pork production facility for NW Iowa.
- Identify structural failure points by type and precedence, include recommendations for alternative reinforcement or repair methods.
- The project was completed as planned, with the only exception being Collin Woodvine leaving the team for the spring semester. Despite this, our team overcame the challenges and stayed committed to providing the client with the desired solution.

Recommendations

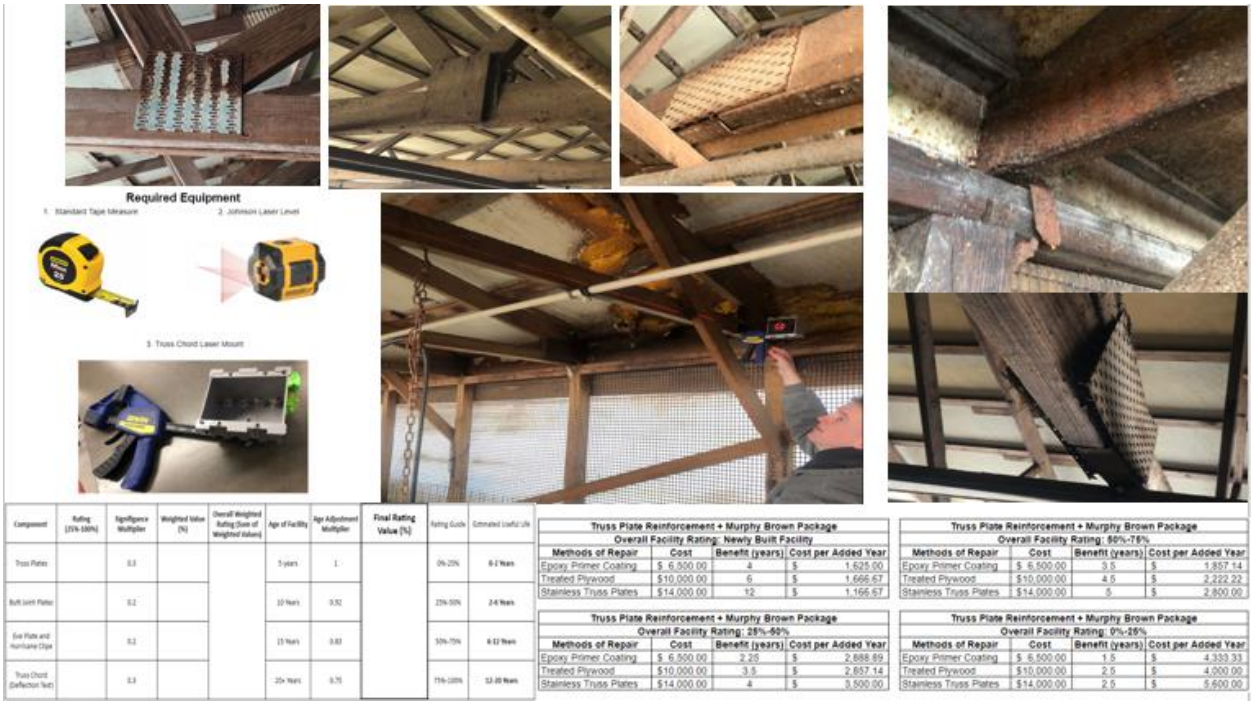
- To stress preventative maintenance to growers for their facilities and give them as many options as possible for repair or replacement.
- Utilize the PM document we supplied them and continuously look for alternative solutions in truss, and facility deterioration recommendations.
- Our focus was naturally ventilated facilities, our test could be utilized for powered facilities as well but it would be more beneficial to make a specific document for them as well.

5 BROADER OPPORTUNITY STATEMENT

Our preventative maintenance document could be implemented by other companies that use naturally ventilated facilities. The nature of our tests and measurements within the document are intuitive and give quick objective recommendations to hog growers that would be beneficial to adopt.

A. Our objective tests and recommendations will raise awareness regarding the safety and wellbeing of growers and livestock. It will enable other midwestern hog growers to analyze their facility conditions and formulate rough facility life timelines.
B. This has been a common problem for Smithfield but is not limited to them. Other pork production companies also have had this problem in the past of truss failure due to harsh operating environments specific to growing hogs
C. Most companies are utilizing treated plywood to reinforce truss connector plates. Our more expensive stainless steel and cheaper epoxy primer options are alternatives that offer benefits at different points in a facility's life.
D. The solution should save money and increase safety awareness for growers in the long term because it gives them different options at earlier stages in the facility life that are cheaper and corrosion-resistant.

6 GRAPHICAL ABSTRACT



Component	Rating (25%-100%)	Significance Multiplier	Weighted Value (%)	Overall Weighted Rating (Sum of Weighted Values)	Age of Facility	Age Adjustment Multiplier	Final Rating Value (%)	Rating Guide	Estimated Useful Life
Truss Plates		0.3			5 years	1		0%-25%	0-2 Years
Butt Joint Plates		0.2			10 Years	0.92		25%-50%	2-6 Years
End Plate and Hurricane Clips		0.2			15 Years	0.83		50%-75%	6-12 Years
Truss Chord (Deflection Test)		0.3			20+ Years	0.75		75%-100%	12-20 Years

Truss Plate Reinforcement + Murphy Brown Package
Overall Facility Rating: Newly Built Facility

Methods of Repair	Cost	Benefit (years)	Cost per Added Year
Epoxy Primer Coating	$ 6,500.00	4	$ 1,625.00
Treated Plywood	$10,000.00	6	$ 1,666.67
Stainless Truss Plates	$14,000.00	12	$ 1,166.67

Truss Plate Reinforcement + Murphy Brown Package
Overall Facility Rating: 50%-75%

Methods of Repair	Cost	Benefit (years)	Cost per Added Year
Epoxy Primer Coating	$ 6,500.00	3.5	$ 1,857.14
Treated Plywood	$10,000.00	4.5	$ 2,222.22
Stainless Truss Plates	$14,000.00	5	$ 2,800.00

Truss Plate Reinforcement + Murphy Brown Package
Overall Facility Rating: 25%-50%

Methods of Repair	Cost	Benefit (years)	Cost per Added Year
Epoxy Primer Coating	$ 6,500.00	2.25	$ 2,888.89
Treated Plywood	$10,000.00	3.5	$ 2,857.14
Stainless Truss Plates	$14,000.00	4	$ 3,500.00

Truss Plate Reinforcement + Murphy Brown Package
Overall Facility Rating: 0%-25%

Methods of Repair	Cost	Benefit (years)	Cost per Added Year
Epoxy Primer Coating	$ 6,500.00	1.5	$ 4,333.33
Treated Plywood	$10,000.00	2.5	$ 4,000.00
Stainless Truss Plates	$14,000.00	2.5	$ 5,600.00

7 REFERENCES

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Iowa State University, Agricultural and Biosystems Engineering: Dr. Harmon, Adam Crutchley Ames, Iowa

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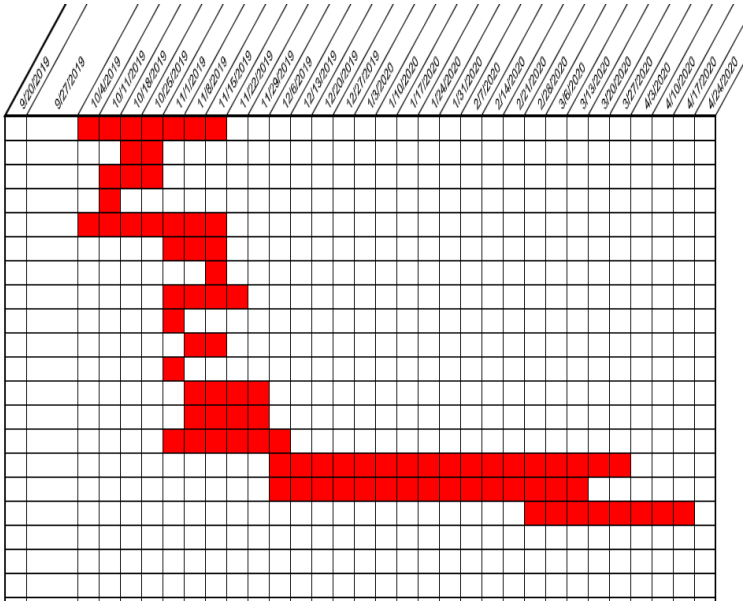
Structural Building Components Association (SBCA), 25 Aug 2015: Quality Assurance Requirements for Metal Plate Connected Wood Trusses, Madison, Wisconsin

Truss Publications Inc, 2011: Structural Building Components, Madison, Wisconsin

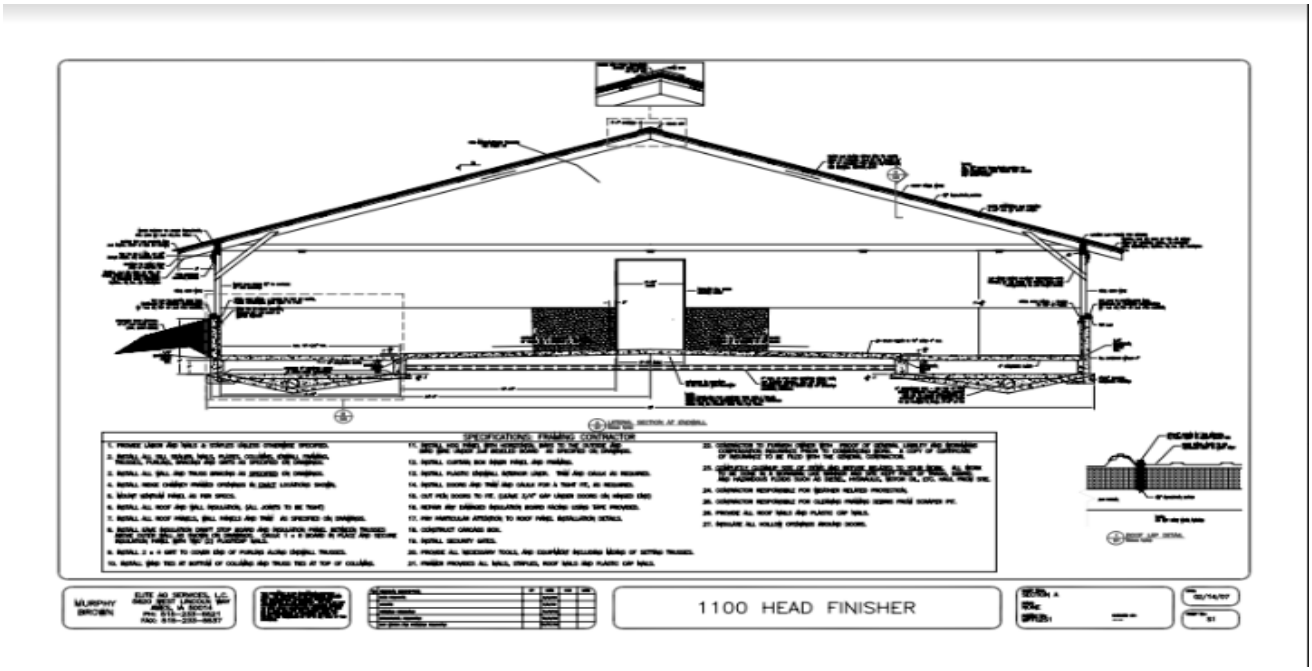
8 APPENDIXES

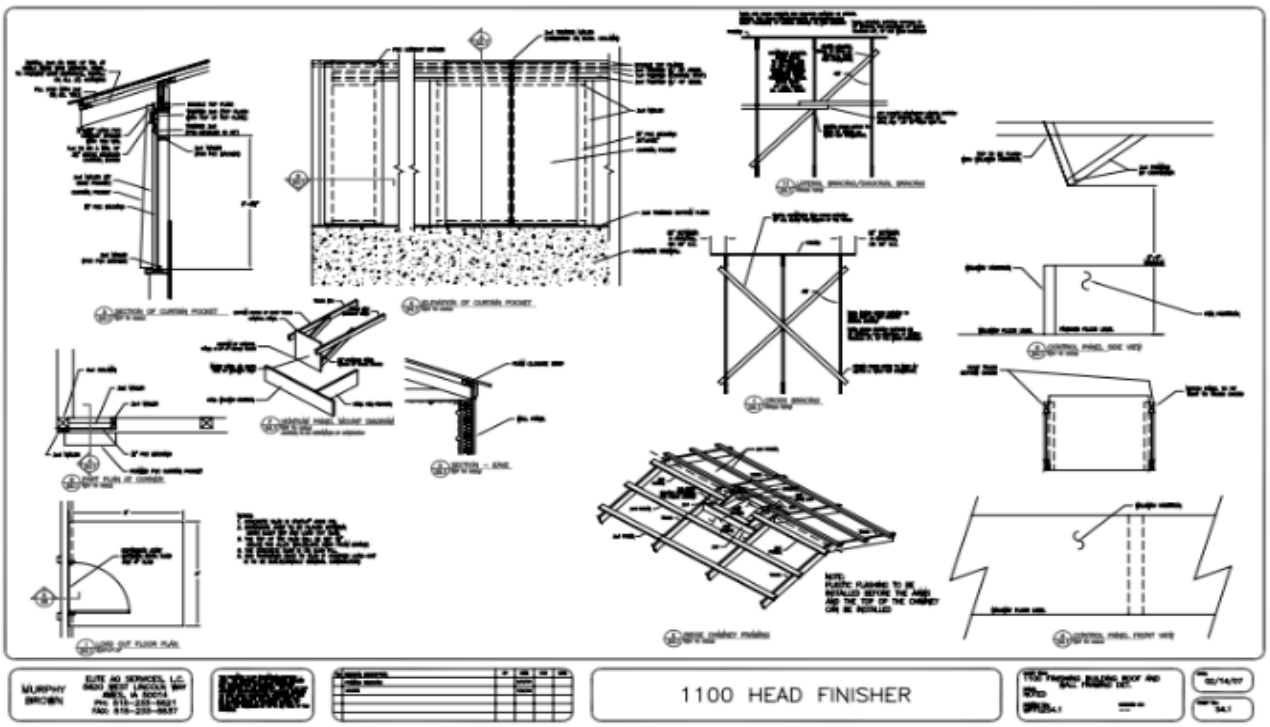
Section 1: Project Timeline

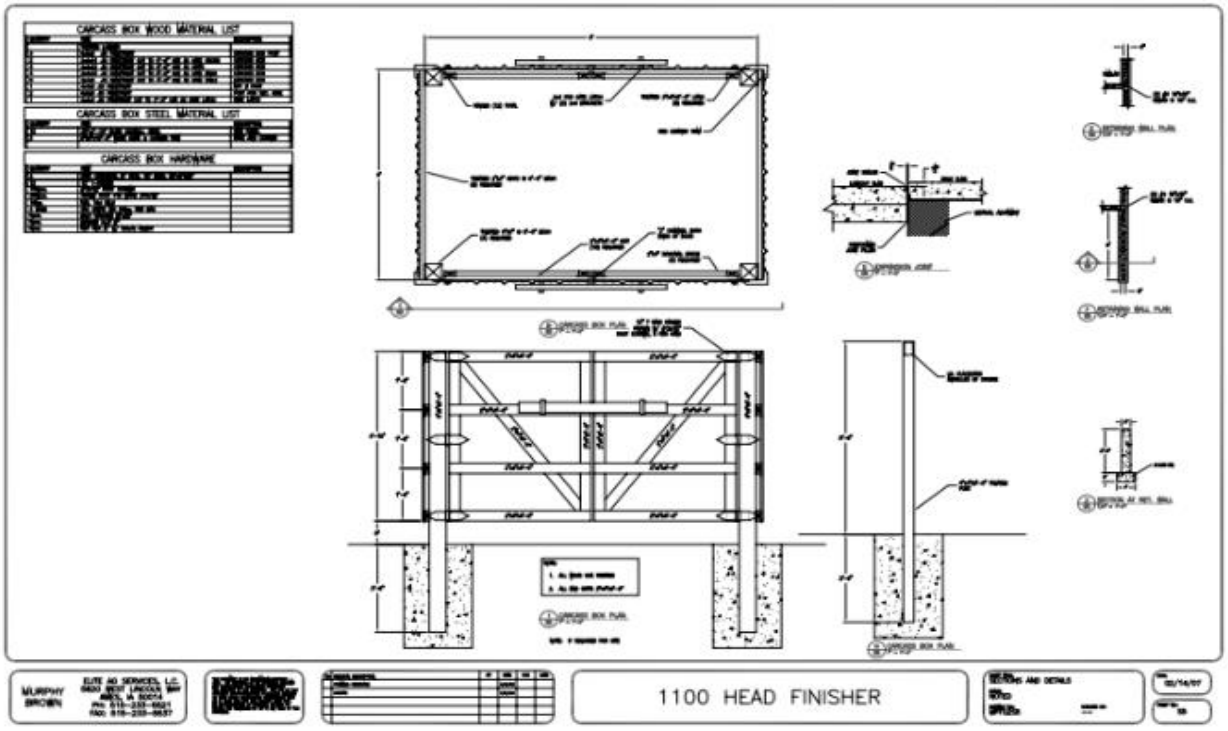
	Work Breakdown Structure	Summary Measurable	Verification Data	On / Off Schedule
1.0	Scope and gatering information			
1.0.1	Returned project agreement forms			
1.1	Define scope for project			
1.1.1	Collect structural drawings			
1.2	Collect information			
1.2.1	Builder information			
1.2.1.1	EPS			
1.2.2	report contact			
1.2.2.1	Brett Ramirez			
2.0	Site Visit			
2.1	Confirm location and logistics			
2.2	review information			
2.1.2	Analysis of components and failure points			
2.3	Brainstorm potential solutions based on scope			
3.0	Build Proposal			
3.1	Organize solution and data			
3.1.1	Develop final proposal and presentation			

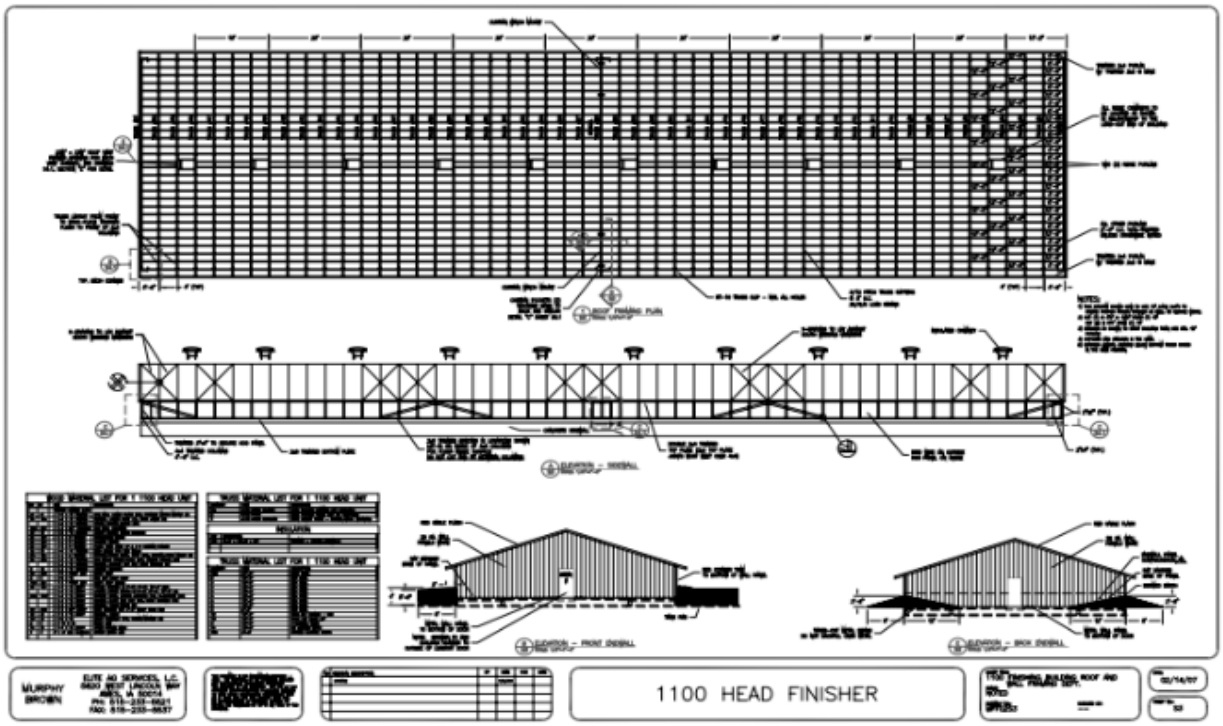


Section 2: Facility Schematics




1100 HEAD FINISHER


CARCASS BOX WOOD MATERIAL LIST
CARCASS BOX STEEL MATERIAL LIST
CARCASS BOX HARDWARE
1100 HEAD FINISHER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Section 3: Truss Evaluation and Reinforcement Packet

Section 3.1: Safety and Purpose

Smithfield Truss Evaluation and Reinforcement Packet 2020

Date:_____ **Facility Location:_____**

Time:_____ **Building Model:_____**

Inspector Name:_____ **Grower Name:_____**

Facility Age:_____

Safety

The objective of this document is to ensure safe and continuous growing operations of the Smithfield naturally ventilated facilities while protecting personnel, livestock, equipment, and all other assets. The recommendations for measured degradation, and repair/reinforcement methods are designed to be objective and repeatable.

Iowa State University, or the Iowa State team, holds no liability for the outcomes of these procedures and recommendations within this document. The packet is for simple and repeatable assessments of structural truss integrity only. Refer to truss manufacturer or truss designer for updated drawings or repairs/changes to initial design.

The overall recommended safe operational life expectancy of Smithfields naturally ventilated facilities in Northwest Iowa based on historical data is approximately 20-30 years if truss reinforcement package has been completed at some midpoint in the facility's life. Life expectancy of a naturally ventilated facility without the truss reinforcement package installed has historically been approximately 15-20 years.

Purpose

This document provides a Preventative Maintenance (PM) checklist manual for identifying and evaluating the deficiencies in structural integrity of trusses in a naturally ventilated hog production facility and a reinforcement plan to improve the overall strength of the facility to extend its useful life. A breakdown of the approximate life of a facility with and without reinforcements is also included alongside the approximate cost of reinforcements.

The PM manual first defines the types, and specific location points of deterioration based on precedence and frequency. A rating system is developed for each component, based on the urgency of action required and is outlined in further detail throughout the document.

Section 3.2: PPE and Required Testing Equipment.

1

PPE

- Shoe covers that comply with Smithfield safety policies and contamination protection
- Safety glasses and full body jumpsuits may be required depending on the operational state of the facility and Smithfield approval
- Remain aware of orientation of Johnson laser level when turning on and off throughout the tests as direct eye contact may result in injury
- Inform Smithfield members before performing tests if you have been in contact with hogs
- Follow all safe work practices be mindful of livestock while performing tests

Required Equipment

1. Standard Tape Measure

2. Johnson Laser Level

3. Truss Chord Laser Mount

Section 3.3: Testing Procedure and Rating Exceptions

2

Truss Evaluation Tests

Evaluation Procedures: Begin by applying each of the 4 following tests to the first truss after the gable end. Repeat all 4 evaluation tests every 5th truss, ending with the last truss before the gable ends on the opposite side of the facility.

Rating Exceptions

Complete separation of truss or butt joint plate teeth from wooden beams on any tested truss results in an automatic 25% rating for evaluation tests. Note the gap between wood and truss plate teeth in the image below.

Reinforcement Adjustments

If the component to be evaluated has been reinforced in the past 5 years increase evaluation score by one grade category(25% - 50% - 75% - 100%)

- For reinforcement technique details see pages 10-15

Section 3.4: Truss Evaluation Tests

3

#1 Truss Plates (At Webbing)

Component Description: Steel plates connecting the webbing of a truss, evaluate all truss plates on for visual deterioration. Record rating for worst condition truss plate on truss.

Component Identification Ratings:

1. 25% - Requires Immediate Repair

2. 50%Reinforcement Recommended

3. 75% - Components Show Minor Wear

4. 100% - No Need for any action

Truss #	1	2	3	4	5	6	7	8	9	10	AVG Rating
Rating (25%-100%)											

4

#2 Butt Joint Plates

Component Description: Steel plates connecting 2, 2x6 bottom truss chords. 2 to 3 connections per truss. Record rating for worst condition butt joint plate on truss.

Component Identification Ratings:

1. 25% - Requires Immediate Repair

2. 50% - Reinforcement Recommended

3. 75% - Components Show Minor Wear

4. 100% - No Need for any action

Truss #	1	2	3	4	5	6	7	8	9	10	AVG Rating
Rating (25%-100%)											

#3 Eve Plates and Hurricane Clips

Component Description: Eve plates(Gussets) and hurricane clips(strips). These components support the connections at the ends of the truss at the wall. Record rating for worst condition Eve Plate/Hurricane clip kit of the pair on each truss.

Component Identification Ratings:

1. 25% - Requires Immediate Repair

2. 50% - Reinforcement Recommended

3. 75% - Components Show Minor Wear

4. 100% - No Need for any action

Picture

Truss #	1	2	3	4	5	6	7	8	9	10	AVG Rating
Rating (25%-100%)											

#4 Truss Chord - Laser Level Measurement (SOP)

Evaluation Procedure:

1. Ensure that the grey laser receptacle box is secured tightly to the metal clamp track by means of the wingnut located at the back of the receptacle.

2. Check that the bottom back edge of the receptacle box is parallel to the metal clamp track.

3. Locate the approximate center point of the truss and begin by attaching the mount directly beneath the center peak.

4. Next, fasten the clamp tightly to the bottom of the truss chord that is being tested using the quick grip adjuster in a generally perpendicular orientation. Ensure that the bottom of the truss chord is resting on the top of the metal clamp track within the clamp jaws.

5. Adjust the perpendicular orientation of the mount with the truss chord by completely centering the bubble in the line level mounted to the user side of the mount.

6. Measure distance from the bottom of the truss chord to the laser line with a standard tape measure. The initial measurement should be taken approximately one foot in front of the laser level and recorded.

7. The second measurement with the standard tape measure should be taken at the furthest point from the center of the truss nearest the eve plate and hurricane clips. Record this distance from the bottom of the truss chord to the laser level line and subtract the difference of the first from the second and this will be your final deflection value to compare to the ratings below.

8. Repeat the test reorienting the mount in the opposite direction on the same truss chord as shown in the demonstration images on the following page.

#4 Truss Chord - Laser Level Measurement

Component Identification States:

2in or greater deflection
1. 25% - Requires Immediate Repair

1 in deflection
2. 50% - Reinforcement Recommended

0.5 in deflection
3. 75% - Components Show Minor Wear

Zero noticeable deflection
4. 100% - No Need for any action

Truss #	1	2	3	4	5	6	7	8	9	10	AVG Rating
Center Measurment											
Wall Measurment											
Difference											
Rating (25%-100%)											

Section 3.5: Overall Truss Structural Rating Table

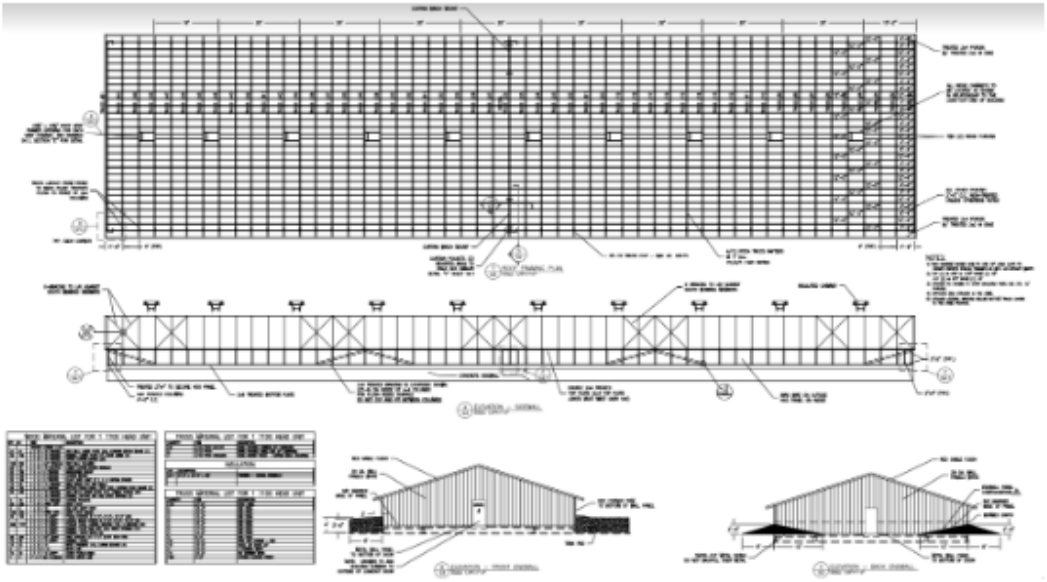
8

Overall Truss Structural Rating Table

Component	Rating (25%-100%)	Significance Multiplier	Weighted Value (%)	Overall Weighted Rating (Sum of Weighted Values)	Age of Facility	Age Adjustment Multiplier	Final Rating Value (%)	Rating Guide	Estimated Useful Life
Truss Plates		0.3			5 years	1		0%-25%	0-2 Years
Butt Joint Plates		0.2			10 Years	0.92		25%-50%	2-6 Years
Eve Plate and Hurricane Clipe		0.2			15 Years	0.83		50%-75%	6-12 Years
Truss Chord (Deflection Test)		0.3			20+ Years	0.75		75%-100%	12-20 Years

NOTE: If any one of the 4 tests have been rated at 37% or lower overall, then immediate repair or reinforcement is required for each component under the criteria.

Facility Layout Reference
(Annotate Major Deficiency Areas Here)



After Action Report of Inspection

General Inspection Notes

Section 3.6: Truss Reinforcement Methods

Truss Reinforcement Methods

Reinforcement Application methods:

1. **Plywood Truss plates** are used to strengthen any truss plates showing considerable deterioration (Rated 50% or lower).
2. **Wind brace** kits are added to **all** trusses at both ends.
3. The first truss after gable end gets an **Eve Bracket/Hurricane clip** kit at both ends of the truss.
4. The same truss that got the eve bracket has the **Butt Joint Bracket** reinforcement.
5. A **2x6** is installed on the next truss.
6. Following truss has only the **wind brace.**
7. Repeat rotation, beginning with the Eve Brackets then Butt Joint Brackets

Plywood on Truss Plates (At webbing)

Reinforcement Description:

- 3/4 inch plywood added overtop existing steel truss plates.
- Secured using screws
- Added to any observed truss plates at a rating of approximately 50% or lower.

Material List: A piece of plywood of equal or greater size than the original truss plate with 8-12 wood screws 1 ¾ - 2" in length

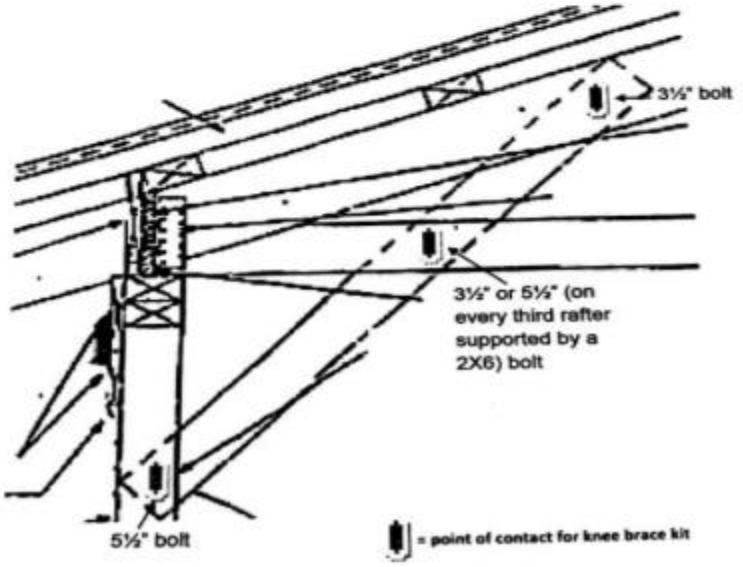
11

Wind Braces

Reinforcement Description:

- Reinforces the connection between the chord, rafter, and 4x4.
- 1 kit every rafter at both ends of rafter
- Applied at wall 4x4's and rafters.
- Secured by SS bolts in 3 places - 4x4, rafter cord, and rafter.

Material List: 3, 5/16" SS bolts per kit, each with a set of washers and nylock nuts.
2 kits per rafter(1 each end).

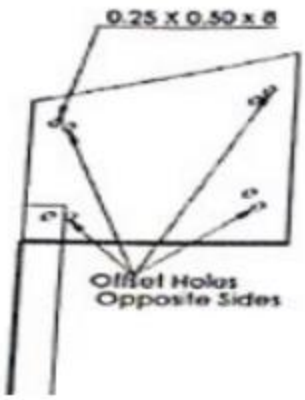


Eve Brackets and Hurricane Clips

Reinforcement Description:

- Reinforce connections at the end of the truss and the wall.

Material List: 2 eve brackets and hurricane clip kits for every truss.
Lag screws for each kit.



Stainless Steel Butt Joint Brackets

Reinforcement Description:

- Stainless steel brackets connecting the butt joints along the bottom truss chord.
- Applied in top or bottom orientation.
- 2 or 3 connection points per truss.

Material List: 2-3 but joint brackets per truss
Lag screws for each location.

13

2 x 6 Added to Bottom Truss Chord

Reinforcement description:

- Additional 2x6 beam added along the length of the bottom truss chord.
- Noted by the brighter colored wood in the visual below.
- Applied every third Truss in rotation with the Butt Joint Brackets.

Material List: Non treated 2x6's
Approximately 60, 12ft long for 1 facility.

Section 3.7: Alternative Truss Design & Repair

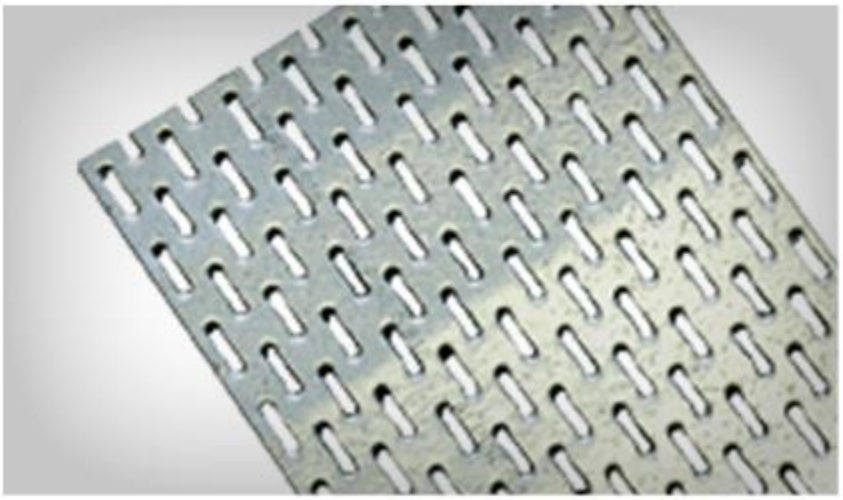
14

Alternative Solutions For Strengthening Truss Plates(At Webbing)

1. **Alpine SS 18 Gauge Truss Connector Plates**

   Advantages: Using stainless steel truss plates as a reinforcement strategy has the potential to add 6-8 years to the life of a facility when implemented with the rest of the reinforcement package.

   Disadvantages: This option is the most expensive of the 3 methods.



Truss Reinforcement Package (Murphy-Brown 2013) + Stainless Steel Truss Plates

Total Price for Complete Reinforcement =	$13,000-$15,000
Added Value for Complete Reinforcement =	6-8 Years

2. Epoxy coating over existing truss plates

Advantages: This epoxy coating is capable of extending the facility life by 3-4 years and is the least expensive option for reinforcing truss plates.

Disadvantages: This method provides the least amount of support and is the least cost effective for the years it extends the facility life.

Simco Coatings Inc.

Manufacturer of Military Spec., Corps of Engrs. Spec, Industrial, & Marine Coatings

TECHNICAL DATA SHEET

SSPC PAINT SPECIFICATION NO.22
EPOXY POLYAMIDE INTERMEDIATE COAT

DESCRIPTION: The coating supplied under this specification is a 2 part epoxy polyamide product composed of a base component and curing agent component. When the two components are mixed in proper proportions, the coating is capable of curing at temperatures as low as 50ºF (10ºC). It can be used as an intermediate coating over primed structural steel, offshore structures, chemical plants, refineries, barges & bridges.

CONFORMANCE: This product conforms to the specific composition and performance requirement of Steel Structures Painting Council (SSPC) Paint Specification No. 22.

TECHNICAL DATA

GENERIC TYPE:	Epoxy polyamide
COLOR:	Red Oxide/Tan/Gray
FLASH POINT:	61º F
SHELF LIFE:	One year
FINISH:	Semi-glossy
MIXING RATIO:	2.25:1 base to hardener by vol.
POT LIFE @ 77ºF:	4 hours
VOLUME SOLIDS:	65.0 ± 1.0%
VOLATILE ORGANIC COMPOUND (VOC):	2.8 lbs. / gal. or 340 g/l
WEIGHT PER GALLON:	12.0 ± 0.2
RECOMMENDED DFT:	3-4 Mils/coat
THEORETICAL COVERAGE:	Est. 950 sq. ft. / gal. @ 1 mil DFT
TEMPERATURE RESISTANCE:	250º F, dry heat
DRYING TIME AT 75ºF:	
A. TACK FREE, HRS:	2 hours
B. HARD DRY, HRS:	5 hours
C. TOPCOAT:	8 hours
THINNER:	Epoxy Thinner

SURFACE PREPARATION: All surfaces must be clean, dry and free from all loose rust, scale, paint or oil. For best results, abrasive blast SSPC-SP6 commercial or SSPC-70 near white.
APPLICATION: Airless or conventional spray is recommended. Small areas may be brushed.

Truss Reinforcement Package (Murphy-Brown 2013) + Epoxy-Polyamide Primer (SSPC-Paint22)

Total Price for Complete Reinforcement = $6,000-$7,500

Added Value for Complete Reinforcement = 3-4 Years

Section 3.8: Cost Comparison Breakdown

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Time and Cost Breakdown of Recommendations

Naturally Ventilated Complete Rebuild Breakdown

Total Price for Complete Facility Rebuild with all equipment (Bid from Pitchfork Ag LLC) :
$168,000

Added Value for Complete Rebuild: **15-20 years** without reinforcement packages installed;
or **20-30 years** if reinforcement packages are installed.

Average cost per added year (25 year life expectancy used in calculation) for Complete Facility Rebuild (Bid from Pitchfork Ag LLC) = **$5,100**

Truss Plate Reinforcement + Murphy Brown Package			
Overall Facility Rating: Newly Built Facility			
Methods of Repair	Cost	Benefit (years)	Cost per Added Year
Epoxy Primer Coating	$ 6,500.00	4	$ 1,625.00
Treated Plywood	$10,000.00	6	$ 1,666.67
Stainless Truss Plates	$14,000.00	12	$ 1,166.67

Truss Plate Reinforcement + Murphy Brown Package			
Overall Facility Rating: 50%-75%			
Methods of Repair	Cost	Benefit (years)	Cost per Added Year
Epoxy Primer Coating	$ 6,500.00	3.5	$ 1,857.14
Treated Plywood	$10,000.00	4.5	$ 2,222.22
Stainless Truss Plates	$14,000.00	5	$ 2,800.00

Truss Plate Reinforcement + Murphy Brown Package			
Overall Facility Rating: 25%-50%			
Methods of Repair	Cost	Benefit (years)	Cost per Added Year
Epoxy Primer Coating	$ 6,500.00	2.25	$ 2,888.89
Treated Plywood	$10,000.00	3.5	$ 2,857.14
Stainless Truss Plates	$14,000.00	4	$ 3,500.00

Truss Plate Reinforcement + Murphy Brown Package			
Overall Facility Rating: 0%-25%			
Methods of Repair	Cost	Benefit (years)	Cost per Added Year
Epoxy Primer Coating	$ 6,500.00	1.5	$ 4,333.33
Treated Plywood	$10,000.00	2.5	$ 4,000.00
Stainless Truss Plates	$14,000.00	2.5	$ 5,600.00